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# Sabará Racial Equity Program: Digital inclusion of black and brown girls in Sabará

**Pedro Henrique de Ávila Vasconcelos[1], Ana Luiza Baião Rodrigues[2], Lillia dos Santos Barsante Silva[3], Márcia Basília de Araújo[4], Carlos Alberto Severiano Júnior[5], Carlos Alexandre Silva[6].**

## ABSTRACT

This article reports the experience of the Sabará Program: Racial Equity, which promoted the digital inclusion of black girls (black and brown) in Sabará. Held by the Federal Institute of Minas Gerais at the Sabará campus in 2023, the program offered programming and robotics courses for students in grades 6 to 9 from public and private schools. The main goal was not only to promote knowledge in technology, but also to strengthen self-confidence and female empowerment. The multidisciplinary approach aimed to stimulate interest in STEAM (Science, Technology, Engineering, Arts and Mathematics) and reduce ethnic-racial and gender disparities in access to technological education. This initiative is essential to expand the representation and participation of black and brown girls in the field of technology and strengthen their presence in historically underrepresented areas.

**Keywords:** Digital inclusion, Black girls, STEAM, Female empowerment, Technology education.

## INTRODUCTION

Despite the technological advances in recent years, female participation in technology is still disproportionate when compared to men. According to UNESCO[7]'s 2021 report, it is estimated that only one woman for every four men in Latin America gets a job in the field of STEAM. The 2023 *Women in Techs*[8] study states that the global average of senior female professionals in the field of Information and Communication Technology (ICT) is only 11%, and that in some places, the scenario is more unequal, such as in the United Kingdom, with the percentage being only 4%. These gender disparities contribute significantly to economic inequality in society.

In 2023, in Brazil, women represented only 20% of ICT professionals, according to data from the IBGE's National Household Sample Survey (PNAD) (SENAC, 2023). Within the female universe, when we look at black women, the statistics reproduce an even more impactful effect. A 2022 survey by PretaLab[9] showed that Black women held only 11% of positions in the tech industry.

[1] Federal Institute of Minas Gerais campus Sabará - pedro.h.avila.v@gmail.com
[2] Federal Institute of Minas Gerais campus Sabará - baiaoluiza2020@gmail.com
[3] Municipal Department of Education of Sabará – MG - lilliabarsante@gmail.com
[4] Federal Institute of Minas Gerais campus Sabará - marcia.basilia@ifmg.edu.br
[5] Federal Institute of Minas Gerais campus Sabará - carlos.junior@ifmg.edu.br
[6] Federal Institute of Minas Gerais campus Sabará - carlos.silva@ifmg.edu.br
[7] https://www.britishcouncil.org.br/sites/default/files/policypapers-cilac-gender-pt.pdf
[8] https://www.womentech.net/women-in-tech-stats
[9] https://gente.globo.com/quem-coda-br/

A study conducted by Microsoft in 2017 revealed that girls' interest in technological topics decreases considerably from the age of 15, although it remains on par with that of boys until the age of 11. Based on interviews with more than 11,500 girls and young women across Europe, the survey highlighted the importance of a 4-year "window of opportunity" to avoid this loss of interest. The digital inclusion of girls is essential to stimulate and motivate the insertion of women in the technology area. Through projects that offer training, mentoring and access to technology, it is possible to arouse girls' interest in this area and prepare them for a successful career.

This article describes an experience report about the Sabará Program: Racial Equity project of the Federal Institute of Minas Gerais Sabará campus (IFMG-Sabará), which aims to insert black girls (black and brown), students from the 6th to the 9th grades of public and private schools in Sabará, in the areas of exact sciences and technology. During the execution of the project, actions were employed on the theme of mathematics and African and Afro-Brazilian culture and identity. In the teaching of programming, the Scratch language was worked on. This programming language was developed by MIT (*Massachusetts Institute of Technology*), and is widely used as a tool to support the teaching of programming in educational institutions, as cited by (SILVA, ALMEIDA and SILVA, 2019), (TOZZI, VIEIRA, *et al.*, 2019), and (RAIOL, SARGES, *et al.*, 2015). A case study presented by (ROCHA) demonstrated the effectiveness of using Scratch for understanding mathematical concepts, highlighting its ease of use even for programming beginners. In the teaching of robotics, Arduino and LEGO kits were used. These approaches help to strengthen the principles of the STEAM methodology and maker culture.

The text is organized as follows. Section 1 provides a brief introduction to the problem and the project proposal. The contextualization and justification of the proposal is described in section 2. The project's implementation methodology is described in section 3. Section 4 illustrates the practical experiences developed and section 5 reports the results obtained, in addition to the discussions and reflections provided. Finally, the conclusion is presented in section 6.

## CONTEXT AND RATIONALE

Currently, we live in a society centered on writing, both in print and digital formats, which influences not only access to information, but also cognitive processes and forms of knowledge. As he points out (SOARES, 2002), the varied spaces for reading and writing bring not only new ways of accessing information, but also new cognitive processes and forms of knowledge. In this context, (MILL and JORGE, 2013) identify three distinct groups: those who do not know how to read and write, those who master writing but have difficulty with digital technologies, and those who master writing and are able to actively participate in digital practices. Digital inclusion, therefore, depends on access to tools and minimal mastery of technology.

In Brazil, the digital divide adds to other inequalities, especially among black and low-income people. As pointed out (SANTOS, 2005), the digital divide means not only the exclusion of access to information, but also the exclusion of knowledge, which deprives people of the possibility of changing their lives and participating democratically in decisions that impact the society in which they are inserted. The 2007 Map of Digital Inequalities in Brazil, as reported (WAISELFISZ, 2007), shows that discrimination based on color or race interferes with the conditions of access to the internet, with whites accessing the internet more than twice as much as blacks.

Sabará, one of the oldest municipalities in Minas Gerais with a population close to 130,000 inhabitants, faces significant inequalities in income distribution, and is among the cities that make up the G100, that is, the 100 Brazilian cities with more than 80,000 inhabitants with the lowest per capita revenues and high vulnerability indices (CARVALHO, MARTINS, *et al.*, 2023). Its history is intrinsically linked to enslavement in Brazil, standing out as one of the main mining villages during the colonial period, with a population of mostly Afro descendants dedicated to gold extraction. Throughout the history of the city of Sabará, the Afro-descendant population (blacks and browns) has always been markedly larger than the white population (COZER, 2017), and contributes with their work, whether compulsory or not, to the enrichment of the white elite, however, they were deprived of any form of power or political rights and the possibility of economic ascension. In this sense, it is justifiable to state that there is a historical debt to be paid to the black population of the city, notably women, who are responsible for a large part of the economic functions of the municipality.

In view of this scenario, the justification for the development of the project to teach programming, robotics and mathematics to black girls in public and private schools in Sabará is elucidated, aiming to promote digital and social inclusion. This initiative seeks to address social inequalities and promote the development of young black women in the region, as highlighted by (CRENSHAW, 2004) by addressing the intersectionality of class, gender, and race. It is worth mentioning that the coordinator of the project is black and has a doctorate in education with research focused on the study of ethnic-racial relations.

## IMPLEMENTATION METHODOLOGY

Initially, a google forms form was made available and published on the IFMG-Sabará website and social networks, in addition to direct dissemination with the Municipal Department of Education of Sabará. A group of 20 self-declared black students, enrolled between the 6th and 9th grades of public and private schools in the Sabará region, was chosen to start the introduction to technology program, accompanied by discussions on racial equity. The selection to participate in the project was based on the order of registration, as well as on proof of education and self-declaration of race/color of the candidates. The course was offered free of charge, and the only expense for the students was individual snacks and

transportation to the IFMG-Sabará campus. Additionally, each student received a school kit that included a personalized T-shirt and backpack, as well as a notebook, pencil, eraser, pen, and pencil case.

The course activities took place at the IFMG-Sabará campus and extended from May to November 2023, with weekly meetings of 3 hours, from 9:00 am to 12:00 pm. The strategic planning chose to hold the course on Saturdays, thus avoiding conflicts in the allocation of physical space on campus and facilitating the participation of the candidates, who attended regular education during the week. In addition, it was common for family members to accompany their daughters to the campus, taking advantage of the public space that until then was little used, which strengthened the ties between IFMG-Sabará and the external community.

The instructors who taught the contents in the project were students from different modalities of IFMG-Sabará, two of whom were permanent instructors and five more in specific actions, in such a way that six of them were women and four of them were black women, in this way we characterized diversity and prioritized female and black representation.

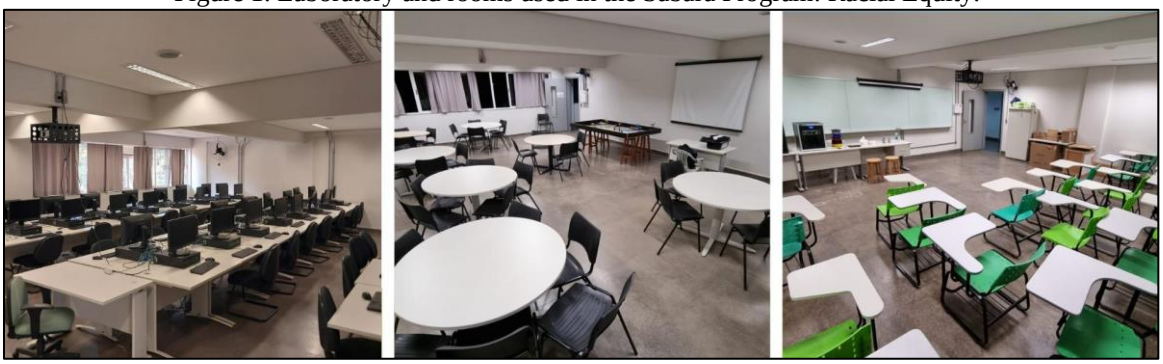
The schedule of course activities is being presented in Table 1.

Table 1: Specification of the activities of the Sabará Program: Racial Equity.

| **Activity** | **Justification/Motivation** | **Number of lessons (3h lessons)** |
|---|---|---|
| Conversation Circle | To spread African and Afro-Brazilian culture. | 1 |
| Scratch | It allows students to create their own interactive stories, games, and animations, encouraging creativity and computational thinking. | 3 |
| Mathematics | Through Tangram, students can get acquainted with flat geometric shapes in a playful and practical way. In addition, creativity was stimulated through the elaboration of an art on paper with the theme of geometry, incorporating representative elements of the culture of Sabará-MG. | 1 |
| Lego Robotics | Through Lego, students can learn engineering and robotics concepts in a playful and practical way. | 2 |
| Conversation Circle | Promote racial identity. | 1 |
| Arduino Robotics | It introduces students to the world of electronics and hardware programming, essential skills in the age of the Internet of Things. | 2 |

The programming and robotics modules were carried out in classrooms and computer labs, which can be seen in Figure 1. The computer labs were equipped with the necessary applications for programming classes and some robotics classes, as well as internet available for access to the virtual teaching environment (*google classroom* was used); the rooms were used especially for robotics classes with LEGO kits using notebooks, facilitating the application of some teaching methodologies and for the exposure and discussion of mathematical themes and ethnic-racial issues.

Figure 1. Laboratory and rooms used in the Sabará Program: Racial Equity.



The teaching of technologies permeated elements of the different active methodologies, such as Project-Based Learning, Game-Based Learning, Team-Based Learning and *Maker Education*, such as the development of activities in teams, learning a topic based on the development of a project or solving a problem, among others. For a better understanding of the application of these methodologies, and the form of discussion on racial equity issues, one can access section 4 of "Practical Experiences" of this work.

## PRACTICAL EXPERIENCES

During the development of the project, it was possible to make a photographic record of some of the activities of the course and it is worth mentioning that the students and instructors signed a term of assignment of images for dissemination purposes. The images to be presented are blurred on the faces, logos and other regions that may make some identification, for the purpose of evaluative review.

Figure 2 represents a relevant moment in the teaching of educational robotics, with the students involved in the practice. Initially, they were introduced to robotics through LEGO kits, valuing their playful and familiar approach, similar to the Scratch programming environment. Subsequently, they moved on to the Arduino platforms, which offer more complex and advanced challenges. This progression illustrates not only the evolution of student learning, but also the diversity of opportunities offered by educational robotics, from introducing basic concepts to exploring more advanced technologies. Educational robotics is an approach that utilizes technology to develop skills such as research, critical thinking, and logical reasoning. It is a practice aligned with the professional future and the development of essential skills.

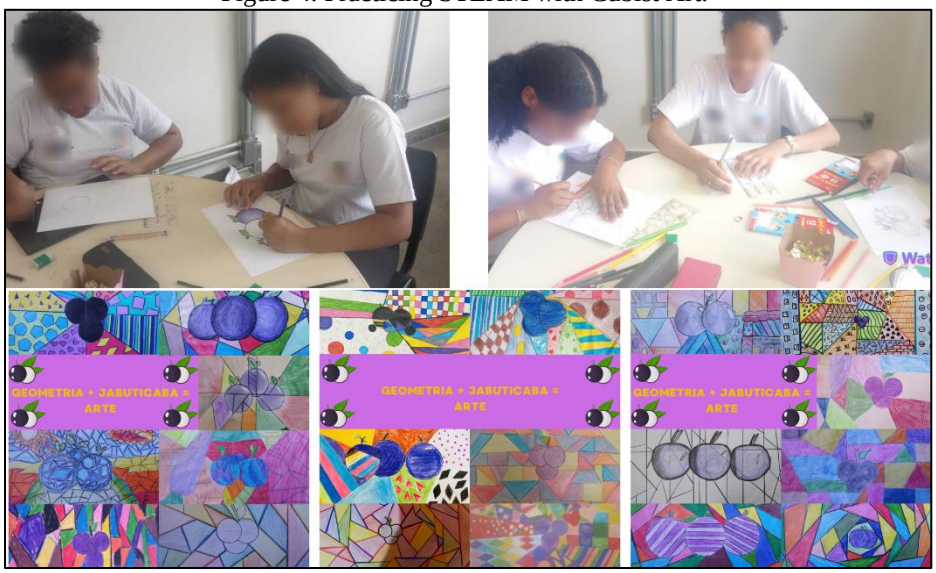
Figure 2. Practicing STEAM with Robotics.

In Figure 3, we can observe the students developing their logical thinking and spatial reasoning skills as they engage in the construction of various flat geometric shapes and representations of animals through the classic Tangram game. This exercise provides a valuable opportunity for female students to explore mathematical and geometric concepts in a practical and visually stimulating way, promoting not only the development of their cognitive skills but also encouraging creativity and team collaboration.

Figure 3. Practicing STEAM with Tangram.

In Figure 4, we can observe the students engaged in the creation of drawings that mix plane geometry and jabuticabas, in response to the local festival in the municipality. This exercise not only stimulates students' creativity but also encourages them to explore the intersection of art and mathematics by integrating visual elements with geometric concepts. In addition, the connection to the local event demonstrates how education can be contextualized, making it more relevant and meaningful for students.

Figure 4. Practicing STEAM with Cubist Art.




In Figure 5, we can observe the students involved in conversation circles on Racial Identity, opportunities in which they had the chance to reflect on fundamental concepts related to the studies of race relations in Brazil and on African and Afro-Brazilian culture. These moments not only promote awareness and understanding of racial issues among female students, but also encourage empathy, respect for diversity, and intercultural dialogue within the educational environment.

Figure 5. Conversation circle.

## IMPACTS

The certificate ceremony was attended by families, members of the academic community and guests. In addition, a video was shown compiling remarkable moments of the course, providing a comprehensive view of the activities and achievements achieved by the participants. This celebration not only recognized the effort and dedication of the students, but also highlighted the positive impact of the program on the school community.

Figure 6 depicts moments of the ceremony for the delivery of certificates of the Programming and Robotics course promoted by the Sabará Program: Racial Equity, with the presence of the graduates' families.

Figure 6. Graduation of the students of the Sabará Program: Racial Equity project.

Figure 7 shows a student invited to share her experiences and knowledge acquired throughout the project, as well as the composition of the solemnity table, composed of five women who played a crucial role in encouraging self-confidence and female empowerment. This female representation in leadership not only inspires the students participating in the course, but also promotes gender equality and underscores the importance of diversity in technology and education.

Figure 7. Ceremony table.

## CONCLUSION

Twenty girls were enrolled in the course, and of these, 18 completed it successfully, and two students did not continue in the project due to incompatibility of the course schedule with the work of the person in charge. In addition to the teaching of programming language and robotics, the course included activities that explored the intersection between Mathematics and Informatics, as well as discussions on Racial Identity, providing moments of reflection for students on fundamental concepts related to race relations in Brazil. We urge all female students to continue their studies in STEAM, programming, and

robotics, emphasizing the need to reduce ethnic-racial and gender disparities in access to technology education.

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